The Orthopedic Treatment of Paralysis of the Anterior Muscles of the Thigh

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THE ORTHOPEDIC TREATMENT OF PARALYSIS OF THE ANTERIOR MUSCLES OF THE THIGH.[1]

We occasionally meet with cases of infantile paralysis in which the patient has lost the power of keeping the knee stiff in the straight position. When such a patient balances himself on the affected limb, a slight blow, or a touch from behind in the popliteal region, flexes the knee and brings the patient to the ground, unless the fall is prevented by sudden action on the part of the unaffected limb. The deficiency is in the anterior muscles of the thigh. The patient, when sitting on the edge of a table, has no power to swing the foot forward, because the muscles which should act on the tibia, through the patella and ligamentum patellæ, are paralyzed. A child thus affected will sometimes manage to walk by forcibly grasping the lower part of the thigh with the hand, in order to hold the knee extended at the critical moment when the weight of the body descends on the affected limb, or he will perform locomotion in a curious manner by advancing alternately the heel and the toe of the well foot, the affected foot trailing on the floor behind. But walking, in the ordinary sense of the word, is impossible, and, unless relief is afforded, the child is thrown on crutches, and the limb is consigned to atrophy and total disability. The hip-joint, the ankle-joint, and the foot may all be well able to sustain the weight of the body, but if the knee is unable to hold itself straight the limb is utterly useless in locomotion. A defect here, like the removal of the keystone of an arch, sends the whole structure to ruin. Disuse leads to defective circulation. The hamstrings contract. The limb hangs useless, it suffers from cold and is liable to chilblains, and in various ways is such an annoyance that, when the patient reaches years of discretion, amputation is demanded and performed, as hap-

[1] Read before the Orthopedic Section of the New York Academy of Medicine, January 21, 1898.

pened in two cases which I can recall. The desperate condition of these patients is further illustrated by the fact that exsection of the knee has been repeatedly performed to secure anchylosis in the straight position.[1] Dr Thomas G. Morton[2] ingeniously formed a stump for the application of an artificial leg by flexing the leg on the atrophied thigh and binding the two together, the foot being in contact with the natis. If these patients had been furnished, from the early age at which infantile paralysis occurs, with a splint which had the power to keep the knee stiff in walking, the circulation would have been encouraged, the limb would have developed to a fair degree, contraction of the hamstrings would have been prevented, and adult age might have been reached with such a degree of stability in the knee-joint that the apparatus might have been discarded.

I desire to present a very simple splint, designed to keep such a limb straight during locomotion. Retentive force applied at the points and in the directions indicated by the arrows in Fig. 1 will keep the limb straight, and this is accomplished by the splint which is represented in Fig. 2.

I do not say that this is not done by other splints. Some of them, however, have so many buckles, straps, movable joints, artificial muscles, and springs, that they are often inefficient and require frequent repairs. The one which is here described can hardly get out of order, and requires attention only when it is outgrown. I therefore make no apology for devoting a few lines to describing its details. In practice the details are quite as important as the principles involved.

In the first place, the splint should be made of tractable steel, so that it may be bent to fit the limb smoothly and avoid the bony prominences of the knee and ankle. The upright may lie on the outer or the inner side of the limb, the choice being decided by the condition of the ankle. As a rule, these cases show some muscular de-

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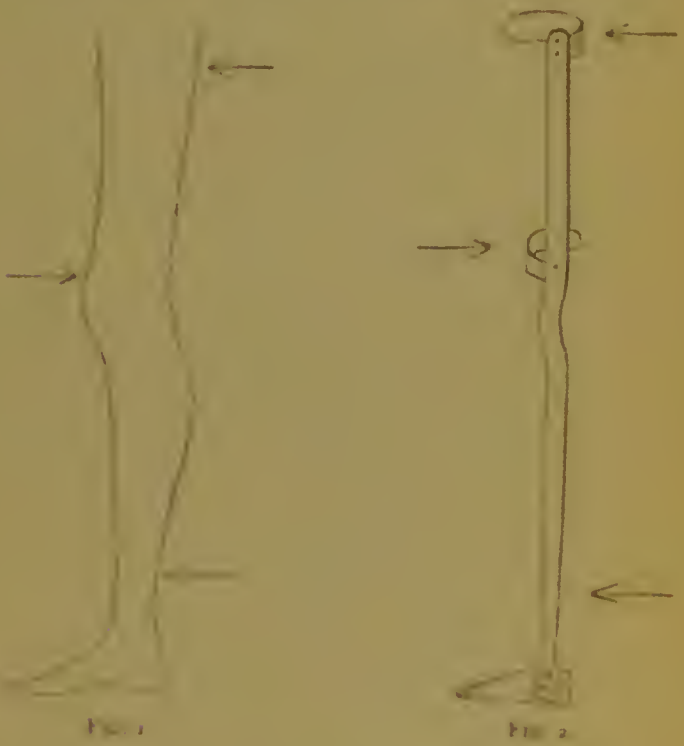
[1] Dr. Stephen Smith: Transactions of the New York State Medical Association, 1884, vol. i., pp. 322–327. Dr. Ap Morgan Vance: New York Medical Journal, November 7, 1885, pp. 512–514.

[2] Philadelphia Medical Times, April 8, 1882, pp. 473, 474.

ficiency at the ankle-joint. The lower part of the splint is therefore practically a club-foot shoe, to be applied on the outer side if the foot inclines to valgus, and on the inner side if the tendency is toward varus. As in the adjustment of an ordinary club-foot shoe, buckles and webbing are to be applied to oppose whatever deformity exists at the ankle. The buckles and straps are not shown in the cut. They are to be attached at such



points and in such numbers, and with such changes from time to time, as will produce the desired effect on the ankle. However applied, they will at once fasten the lower part of the splint to the foot in such a manner that when the entire apparatus is adjusted a retaining force will be exerted at the point and in the direction indicated by the lowest of the three arrows.

The upper part of the splint, as shown in the figure, is so simple that it hardly needs a verbal description. Steel

bands of tolerable firmness, each long enough to more than half encircle the thigh, are riveted to the upright. The splint is readily applied by placing it against the middle of the thigh, with the upright at right angles with the femur. Then, when the upright is brought down parallel with the limb, the two bands will find bearings—the upper one against the upper and posterior, and the lower one against the lower and anterior part of the femur. The application is then completed by buckling the straps of the foot-piece. The bands will retain their hold of the limb without the help of straps and buckles. If hyper-extension of the knee is present in too great a degree, it may be opposed by the addition of two straps, one crossing the upper and anterior part of the thigh, and the other attached to the free end of the lower band, and crossing the popliteal region obliquely, to be buckled to the upright below the level of the knee. It is clear that the shape of the bands is a matter of the greatest importance. As a rule, it may be said that they should be curved in such a manner that, when the splint is looked through endwise, the lumen formed by the two bands should not very much exceed in its antero-posterior measurement the diameter of the shaft of the femur.

The bands and that portion of the upright included by them may be wound with a strip of gum-plaster to prevent rust, and then with canton-flannel, muslin, or silk. The stocking will interpose between the skin and the lower part of the splint. The foot-piece, which is covered by the patient's shoe, is to be lined with plaster and a piece of leather fastened with two rivets. When the patient grows, and the length of the limb makes it inconvenient to sit with the knee extended, a joint may be added to the splint, at the level of the knee, with some device for locking in the straight position when the patient rises.

It may be said that the steel bands should be thickly padded. In reply, I would say that, after many experiments with padded apparatus of different kinds, I have come to the conclusion that a brace is to be made comfortable, not by the addition of wadding, but rather by properly distributing the pressure which it makes. In gen-

eral terms, whatever retentive pressure is to be made on the bony prominences in the vicinity of the joints should be made, not by the metallic portions of the brace, but by straps of webbing which should draw the deformed parts into a concavity formed by bending the steel frame of the brace. But when pressure is to be made on the shafts of the long bones, which are, as a rule, provided with a natural pad of muscular and cellular tissue, the metallic portion of the brace may be brought in contact with the skin, with the interposition of a slight layer of some protective material. But in such cases great pains should be taken to bend and twist the steel until the entire surface of contact is evenly applied to the bony surface.

The custom of using braces of all kinds with pads and cushions is to be deprecated. Too often they accomplish very imperfectly what could be perfectly done by properly bending or twisting the steel frame of the brace. The best way to reconcile the patient to the inconvenience of wearing a brace is to furnish one which is of service in assisting locomotion or preventing pain. Such a brace may of necessity be heavy, unsightly, and harsh to the unaccustomed skin, but the patient will be eager to wear it as soon as he perceives the fact that the pleasure and comfort and convenience attending its use outweigh the inevitable discomforts. I have seen many instances in which thick and elaborate pads have been voluntarily discarded in favor of hard and simple coverings more in accord with the patient's own idea of comfort, cleanliness, and convenience.

The splint here described is not to be worn at night. It is to be applied as soon as it becomes clear that the anterior muscles of the thigh are permanently incapacitated by the paralytic attack. Without it, or its equivalent, the patient can walk only with the help of crutches, and then only with the burden of a worse than useless limb. With the splint the paralyzed limb resumes its duty and the crutches are thrown away. If, perchance, both of the lower extremities are affected in this way, a splint of this kind is to be applied to each limb. Without them locomotion is possible only by the hands and

arms as the patient sits or lies on the floor, and a wheel-chair or a bearer becomes in time a necessity. But with the splints the limbs resume the power of sustaining the body in the erect position, and locomotion with crutches becomes practicable.

It is not to be expected that patients wearing a splint for paralysis of the anterior muscles of the thigh will walk with perfect ease and grace. The advantages of the use of the splint are to be found in a greater ability to walk and in the good condition of the limb, which is secured by its constant use from infancy. I have a number of patients under treatment as above described. The case which best illustrates the usefulness of this splint is the one which has been under observation the longest. A girl was attacked with infantile paralysis when two years of age, in August, 1875. In 1877 the splint was applied. At that time the patient presented a typical case of the kind under consideration. The thigh was extremely atrophied. She could not walk, nor could she, without the splint, put her weight on the affected limb. At the present time, the girl being fourteen years of age, the limb is well nourished and fairly developed. There is no contraction of the hamstrings. There is no deformity except what comes from shortening and paralytic flat-foot. She can take a few steps without the splint. The articular surfaces of the knee are broad and kept in perfect coaptation, and she is likely to have a very useful limb when she reaches maturity.

The evident simplicity, moderate cost, and durability of this splint are points in its favor. But because it is simple in its construction it does not follow that its application and proper adjustment are matters that may be lightly dismissed. We find the skeleton of the lower extremity unable to support the weight of the body, and seek to re-enforce it by a supplemental skeleton of steel, the two to be brought together with the interposition of the sensitive skin. The problem, like many which present themselves in orthopædic practice, requires time, a practised mechanical sense, and good-natured and patient attention to details.

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